ROYAL ASTRONOMICAL SOCIETY.

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THE following communications were read:—

I. Observations of Biela's Comet, from Nov. 18, 1832, to Jan. 3, 1833. By T. Henderson, Esq., Astronomer at the Cape of Good Hope.

These observations were made with a telescope by Dollond, of 45 inches focal length, and $3\frac{1}{2}$ inches aperture, power 30; and a circular micrometer by Simms, with a radius of 1015 seconds of arc.

The comet was looked for on the 18th of November, when it had just entered the southern hemisphere, and was immediately seen in the place given in the Supplement to the *Nautical Almanac*.

The places of the comet were obtained from comparison with various stars, the approximate places of which are given, and which were in course of observation when the paper was written. The comparisons are corrected for the comet's parallax and motion, but not for refraction; the latter quantity being much less than unavoidable errors of observation.

The comet became invisible after Jan. 3, owing to the increasing moonlight. After the lapse of a fortnight, when the moonlight was gone, it could not be seen, though carefully looked for.

II. Various Observations made at the Observatory of the Cape of Good Hope. Communicated by T. Henderson, Esq.

1. Observed transits of the moon and moon-culminating stars, from Nov. 3, 1832, to April 13, 1833. By Lieut. Meadows, R.N.

2. Observations of the moon and stars made with the mural circle, from March 4 to April 3, 1833.

3. Observed eclipses of *Jupiter's* first and second satellites, from Nov. 9, to Dec. 25, 1832.

4. Observed lunar occultations, from Nov. 10, 1832, to April 2, 1833.

This series of observations made at the Cape Observatory by Messrs. Henderson and Meadows, is a continuation of those already communicated. (See *Monthly Notice* for May 1833.)

III. Observations of *Mars*, and stars observed with *Mars*, near the Opposition, between Oct. 14 and Dec. 22, 1832, at the Observatory, St. Helena. By Lieut. Johnson.

These observations were made with the mural circle, and are corrected for refraction and instrumental errors, the former by Dr. Young's table.

IV. Observations of the Magnitude, Colour, and Brightness of Stars in the Southern Hemisphere. By James Dunlop, Esq., Astronomer at Paramatta.

This paper contains determinations by Mr. Dunlop of the size or apparent diameter of the disc of several stars, by means of the double-image eye-piece. A scale of magnitudes being thus obtained, he has viewed and carefully noted the appearance of about 400 southern stars, specifying the character of each under the heads of magnitude, lustre, and colour. Individual comparisons between neighbouring stars are frequently given, which will enable observers to discover any changes that may hereafter occur.

V. Observations of several Meridian Transits of the Moon. By the Rev. M. Ward.

These observations were made with a view of calling the attention of astronomers to the question whether meridian transits of the moon, in the present improved state of the *Nautical Almanac*, might not give the longitude in time with a precision not greatly inferior to other methods.

VI. Observations of Occultations and Eclipses made in the year 1832, at Biggleswade, with the Wollaston Telescope. By T. Maclear, Esq.

On the power of the telescope Mr. Maclear remarks, "power 130 seems to be the best for observing the eclipses of *Jupiter's* satellites. At immersion, even the first satellite is first seen as a very fine point, and sometimes with the second satellite 40 seconds elapse before it is visible to another observer with a 30-inch telescope."

VII. Description of a small Observatory erected at Biggleswade. By T. Maclear, Esq.

The Memoirs will contain the full description of Mr. Maclear's observatory. As the detailed explanation would be of little service, unaccompanied by the designs, we can here only state, that it consists of a transit-room, and of one with a revolving dome for the telescope. The clock in the former is supported, independently of the case, by stone brackets, projecting from a stone pillar. The telescope-room is built of wood, of an octagonal form, and the dome is hemispherical, the opening extending from the zenith to the horizon, with a sliding shutter easily opening in whole or in part, so that the dew can be kept off the object-glass. The telescope is supported on a solid oak plank, of 18 inches diameter, three feet in the ground and five out of it. This answers as well as brick-work; and Mr. Maclear has not found the slightest tremor

even in high winds. The total expense of this room was fifty pounds.

VIII. An Approximate Method of finding the Latitude from two Altitudes observed near the Meridian, with the interval of time. By Lieut. Raper.

The object is to obtain the meridian altitude from these elements, without knowing either the absolute apparent time, or whether the altitudes are both observed in the same or different sides of the meridian.

The problem is considered as a question of differences; and the second difference of altitude, supposed constant, is computed, for this particular purpose, from the expression

$$\Delta^2 u = 15 \times 2 \frac{\sin p \cos l}{\cos a} \sin \frac{\Delta P}{2} \cdot \Delta P;$$

u being the altitude, p the polar distance, l the latitude, a the lesser altitude, and ΔP the interval or difference of time. The errors of the process are such as partially to compensate each other, and the method holds good to about one hour on both sides of the meridian, that is, the interval may be any time from five minutes to nearly two hours in these latitudes, and less than one-third of these limits in low latitudes.

1. When the time from noon (in the case of the sun) exceeds the interval, the second difference being continually subtracted from the difference of altitudes, and the remainders added to the greater altitude, gives the meridian altitude near enough for sea purposes, when the interval is small.

2. When the interval exceeds the time from noon, the addition to the greater altitude is

$$\frac{(\Delta u - \frac{1}{2} \Delta^2 u)^2}{\Delta^2 u};$$

which also serves to correct the process in the first case, when the interval is large.

3. When the sun has crossed the meridian in the interval, one-eighth of the second difference is a correction, which, added to the mean of the two altitudes, gives the altitude at the middle time: the mean of this altitude, and the greatest, increased by one-fourth of the former correction, is the altitude at the next subdivision, and thus the meridian altitude is quickly converged to.

These three cases will commonly declare themselves in practice; but if a case is doubtful, it can be very simply discovered which it is.

By this principle of solution the errors of observation do not affect the results in the same manner as they do the solutions by spherical trigonometry.

IX. Notice of the Elliptic Orbit of ξ *Boötis*, with a further Approximation to the Orbit of γ *Virginis*. By Sir John Herschel.

The elements of the orbit of ξ *Boötis* are given for the first time; those of γ *Virginis* are recalculated by the aid of observations made in the current year, by Sir J. Herschel and others, which differ materially from the *Ephemeris* published in the Supplement to the *Nautical Almanac* for 1832. Comparisons of the calculated results, with observations, are given in both cases.

The elements are as follow:—

ξ *Boötis.*

Semiaxis major	$a = 12''{\cdot}56$	Inclination to the plane of the sky	$\gamma = 80°\ 5'$
Excentricity	$e = 0\ {\cdot}59374$	Position of node	$\Omega = 359°\ 59'$
Pos. of perihelion	$\varpi = 138°\ 24'$	Period in tropical years	$P = 117{\cdot}14$
Angle between lines of nodes and apsides	$\lambda = 100°\ 59'$	Mean motion	$n = -3°{\cdot}0733$

Perihelion passage, Dec. 17, 1779.

"These elements are interesting in several respects. In the first place, the period they indicate fills up an intermediate and wanting link between the short periods of η *Coronæ*, ξ *Ursæ*, &c. and the much longer ones of *Castor*, σ *Coronæ*, 61 *Cygni*, γ *Virginis*, &c. establishing (so far as we can at present rely on such determinations) a connected scale of periods, from less than half a century to upwards of six centuries. The great amount of the excentricity of the orbit in question strengthens the induction which already begins to assign, in no unequivocal manner, orbits rather of a cometary than a planetary character to the binary stars generally. This orbit, moreover, is the most oblique to the line of sight which has yet been calculated; and as the apparent position of the projected perihelion is not very far from making a right angle with the line of nodes, the longer axis of the real ellipse is violently foreshortened, and the whole character of the apparent ellipse completely distorted, as seen in projection, from what it is in reality."

γ *Virginis.*

Major semiaxis	a	$= 12''{\cdot}090$
Excentricity	e	$= 0{\cdot}8335$
Perihelion projected	ϖ	$= 36°\ 40'$
Perihelion from node on the orbit	λ	$= 282°\ 21'$
Inclination to heavens	γ	$= 67°\ 2'$
Node	Ω	$= 97\ 23$
Period in tropical years	P	$= 628{\cdot}90$
Mean annual motion	n	$= -0°{\cdot}57242$
Perihelion passage	τ	$= 1834{\cdot}63$

X. On the Adoption of a Standard of Optical Power by Observers. By the Rev. W. R. Dawes.

"Almost from the first invention of telescopes to the present day, the eclipses of *Jupiter's* satellites have afforded matter of interest to the astronomer, and to all who are anxious for the improvement of geographical science. Unhappily, however, notwithstanding all which has been done to improve this most simple method of determining differences of terrestrial longitude, there are few observa-

tions whose results are less satisfactory. Nor will this excite surprise, if it be considered, that the instant when any of these phenomena is observed is greatly influenced by the circumstances under which it is witnessed. When observed at different places, the results may be affected by diverse states of the atmosphere, and altitudes of the planet; besides the varieties existing in the *instruments* employed, and the *eyes* which use them. But though it is beyond our power to control the state of the atmosphere, or to alter the situation of the planet, we may, I conceive, do much to remove the enormous discrepancies arising from the differences in the optical power and acuteness which are brought to bear on this interesting class of phenomena.

"It might be supposed, perhaps, that a sufficient agreement of optical power might be obtained by fixing on a certain aperture, and a suitable magnifying power, as a standard to be adopted by all observers who are desirous of determining differences of longitude by means of these eclipses. And, no doubt, a much nearer approach to what is desirable would be thus obtained, than can be expected while some are employing telescopes possessed of immensely greater illuminating power than those used by others for the same purpose. However important in other respects observations may be, made in well determined stations, with large instruments, they are obviously not comparable with the results obtained by such instruments as are usually possessed by private individuals of astronomical taste, and to whom this species of observation is commonly very interesting, and would be more so were its results less unsatisfactory. Yet, were we to agree to cut down the larger instruments to a certain aperture, we should still leave two sources of disagreement unprovided against, which however are within our control. First, the instruments thus *apparently* placed on a footing would differ much in excellence, and consequently in the time when they would render an immerging or emerging satellite only just visible. Secondly, even could this point be adjusted, there would remain the very great variety which exists in different individuals in respect of *acuteness of vision*. This I believe to be much greater than is generally supposed; for I know it to be such, in some instances, as to render the 42-inch achromatic telescope as efficient an instrument to one observer, in discerning minute points of light, as a 5-feet achromatic is to another; each instrument having its usual aperture, and being of corresponding excellence. In further proof of this, I may advert to the fact, that in every instance in which Captain Smyth and myself have witnessed the same *emersion*, the satellite appears to have been first discerned by me; the instrument used at Bedford being, as I understand, the excellent $8\frac{1}{2}$-feet achromatic of nearly 6 inches aperture, and consequently possessing an illuminating power of between two and three times greater than that of my 5-feet achromatic. Hence it is manifest that some plan must be devised for equalising the optical powers of the different *observers and their instruments*, the *eye* and the *telescope* being viewed as one compound optical machine. And

this being attained, the varying condition of the atmosphere would alone be uncontrollable; for I imagine the differences of the planet's altitude might be very nearly allowed for by a corresponding alteration in the aperture or power generally used.

"I would therefore earnestly recommend the adoption of some celestial object as a *standard* of the optical power to be employed; and I know of none possessing so many advantages as the minute companion of *Polaris*. It is readily found, is visible throughout the year, and preserves nearly the same altitude. Let each observer then ascertain, by a series of experiments on several clear nights, what is the *minimum aperture* with which his instrument will enable him, on an average of such nights, to keep this delicate object *just steadily* in view. Perhaps it would be proper to fix the power employed at about 80. This power is very usually attached to the $3\frac{1}{2}$-feet achromatic, the aperture of which instrument will, I imagine, to most eyes, admit of a little diminution to bring it to the proposed standard. This telescope is, moreover, not an uncommon one among observers; yet I am disposed to regret, that the object I have selected as on the whole the best, is not sufficiently visible with the usual 30-inch achromatic. For, the greater the number of observers engaged, the more interesting and useful are the results likely to prove.

"It appears to me, that by the adoption of this plan, all the observers of these phenomena would be placed as nearly as possible on an equal footing, and every source of uncertainty within our control would be removed. I am not, indeed, prepared to suggest precisely the best mode of meeting the differences of the planet's altitude, as seen from different places; but this will not vary enormously in the British Isles; and if the plan should meet with the approbation of observers within these limits, and by them be subjected to a fair trial during the next apparition of *Jupiter*, further details and improvements may be brought forward, should the method be thought worthy of general adoption.

"It would, of course, be highly desirable that the same mode of observation should be pursued (in respect at least of *one* instrument and observer) at the principal observatories, whose longitude is accurately settled, as the results thus obtained would have great influence in determining the question of its practical utility.

"I need not dwell on the importance of distinctly specifying the *atmospheric circumstances* under which these observations are made, as otherwise it will be impossible to judge of their comparability. It might also conduce to further improvement of the method, if the planet's *hour-angle* or *estimated altitude* were recorded, and it would be convenient were the same *denomination* of time employed in registering the observations; or if both the sidereal and mean time were given, as in the Greenwich Observations.

"Should this subject be found to possess sufficient interest to engage a few careful observers in thus watching for the eclipses of *Jupiter's* satellites during the present year, the results might be communicated to the Society, so as to appear in one of their *Monthly*

Notices during the session of 1834; and thus evidence would be had, at one view, of the degree of advantage to be expected from the adoption of such a plan of simultaneous and uniform observation."

XI. Description of a Double Reflecting Circle, and of a Quadruple Reflecting Sextant, made by Mr. Jones, of Charing Cross, under the direction of Captain W. F. Owen, R. N., and presented by the latter to the Society.

The first instrument consists of two parallel circles of reflection, each being a separate reflecting circle, on Troughton's principle, with four indices. These several readings Capt. Owen proposes to reduce to one, by a table exhibiting all the corresponding readings at every degree for 140° on each side of zero.

When each circle is used independently, the instrument differs in nothing from Troughton's reflecting circle; when the two are used together, they are capable of measuring the two angles subtended by three objects in the same plane at the same instant. This is done by bringing the right and left-hand objects in contact with the middle one. If the middle object is wanting, the contact of the other two can be made. Such an arrangement also admits of small angles being measured on many parts of the divided scales, and thus destroys the errors of division.

The instrument was constructed for the purpose above mentioned, of measuring the angles between three objects, which is a problem of extensive utility in sea-surveying. It also measures altitudes in low latitudes, when they are beyond the limits of the sextant or circle. By this instrument, also, the angular distance is measured between the two opposite horizons, and the value of the apparent dip thus obtained, which Captain Owen has observed to differ considerably from that in the tables, from the effects of terrestrial refraction.

A quadruple reflecting sextant (also by Jones) was presented on the same occasion, by Captain Owen. This instrument measures four angles at once, and is designed for similar purposes with the preceding, whose principles it in part combines.

XII. Transits of the Moon with Moon-culminating Stars observed at Cambridge Observatory, in the months of March, April, May, and June, 1833.

Day.	Name.	Clock Time of Transit. h m s	Clock's losing rate. s
March 4.	q Cancri	9 9 30,90	+2,15
	δ Leonis	9 27 41,01	
	Moon 1 L	9 53 7,41	
	ϱ Leonis	10 23 52,71	
6.	ξ^1 Virginis	11 36 27,97	1,86
	Moon 2 L	12 0 51,67	

Day.	Name.	Clock Time of Transit. h	m	s	Clock's losing rate. s
April 1.	37 Leonis	10	6	53,06	+ 2,12
	42 Leonis	10	12	1,43	
	Moon 1 L	10	29	51,59	
3.	*b* Virginis	11	50	30,37	2,05
	c Virginis	12	10	58,80	
	Moon 1 L	12	25	30,46	
	γ Virginis	12	32	18,83	
28.	η Leonis	9	56	25,01	2,28
	Moon 1 L	10	7	28,38	
	ϱ Leonis	10	22	12,53	
May 3.	$\varkappa$ Virginis	14	4	1,02	2,19
	2 Libræ	14	14	28,33	
	Moon 1 L. (ragged)	14	46	11,42	
	Moon 2 L	14	48	26,18	
	γ Libræ	15	26	12,92	
May 4.	α^2 Libræ	14	41	38,17	2,17
	γ^1 Libræ	14	57	18,44	
	γ Libræ	15	26	10,65	
	Moon 2 L	15	43	33,62	
28.	η Virginis	12	10	27,62	2,24
	Moon 1 L	12	38	1,30	
	k^1 Virginis	12	50	9,57	
	k^4 Virginis	12	54	24,46	
29.	Moon 1 L	13	30	55,61	2,30
	$\varkappa$ Virginis	14	3	3,74	
30.	$\varkappa$ Virginis	14	3	1,59	2,34
	Moon 1 L.	14	23	54,06	
	μ Libræ	14	39	12,54	
	ξ^2 Libræ	14	46	44,85	
31.	Moon 1 L	15	17	36,67	2,20
	η Libræ	15	33	41,00	
June 29.	Moon 1 L	16	47	46,49	2,44
	D Ophiuchi	17	32	17,90	

*** *This number closes the second volume of the Monthly Notices; an Index to which is in preparation, and will accompany the first number of the next volume.*

J. Moyes, Castle Street, Leicester Square.

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